

SUMMARY OF FIRE PROTECTION PROGRAMS FOR CALENDAR YEAR 2000



UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF SAFETY AND HEALTH (EH-5)

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TABLE OF CONTENTS

FOREWORD	iii
GLOSSARY	iv
DEFINITIONS.....	vi
EXECUTIVE SUMMARY	1
DOE PROPERTY LOSS EXPERIENCE.....	1
SUMMARY OF FIRE DAMAGE INCIDENTS.....	10
WATER-BASED AUTOMATIC SUPPRESSION SYSTEM PERFORMANCE.....	12
NON WATER-BASED FIRE SUPPRESSION SYSTEM PERFORMANCE	15
RECURRING FIRE PROTECTION PROGRAM COSTS.....	17
CONCLUSIONS.....	19

FOREWORD

This edition of the Annual Fire Protection Program Summary for the Department of Energy (DOE) continues the series started in 1972.

Since May 1950, an Annual Fire Protection Program Summary (Annual Summary) has been submitted by DOE's fire protection engineering community under the requirements of DOE's predecessor agencies: the Atomic Energy Commission (AEC) and the Energy Research Development Administration (ERDA). An Annual Summary is currently required by section 5a.(8) of DOE Order 231.1, "Environment, Safety and Health Reporting" which replaced DOE 5484.1, "Environmental Protection, Safety and Health Protection Information Reporting Requirements".

Accident reports required by DOE Order 231.1 are compiled within the Computerized Accident Incident Reporting System (CAIRS) from different field organization sources than those submitting the Annual Summary. Each quarter, CAIRS issues the Occupational Injury and Property Damage Summary that statistically reports on DOE loss topics such as fatalities, injuries, illnesses, fire, and non-fire losses. The Annual Summary however, takes a more comprehensive look at the DOE fire protection program. Fire loss statistics are provided, as are reports on a broad range of fire protection activities including; automatic suppression system performance, fire department responses, and the recurring cost of fire protection at DOE sites. Fire loss statistics from the Annual Summary are also validated with the CAIRS fire loss reports, and trended against the CAIRS non-fire loss data. Discrepancies with either loss statistic are investigated and corrected as necessary.

The report for calendar year (CY) 2000 was summarized from information sent to Headquarters by 44 out of 60 reporting elements, representing approximately 80 percent of DOE's holdings. For comparison purposes, field offices are arranged according to the CAIRS reporting format, with a total of 21 categories represented. Abbreviations are identified in the Glossary, as are the DOE site reporting elements and major definitions.

In 1999, an initiative was undertaken to automate the Annual Summary reporting process to streamline data collection and provide a more thorough review of DOE Reporting Element activities. This action resulted in the delayed publication of the CY 1999 and 2000 reports until 2002. It is now possible however to view all Annual Summary Reporting Element responses since 1991 at the Site, Operations, Lead Program Secretarial Office and Headquarters levels. Additionally, a built-in reference to other DOE reporting activities (CAIRS and ORPS) is available that allows Reporting Elements and managers the opportunity to review all fire protection events along previously mentioned categories. For example, the information contained in this publication was extracted from the Annual Summary Application at the Headquarters level for CY 2000. To obtain a copy of the Annual Summary Application please contact Jim Bisker in the Office of Nuclear and Facility Safety Policy (EH-53) at 301.903.6542 or jim.Bisker@hq.doe.gov.

GLOSSARY

Field organization abbreviations:

AL	Albuquerque Operations
CAO	Carlsbad Area Office
CH	Chicago Operations
FETC	Federal Energy Technology Centers
GFO	Golden Field Office
HQ	Headquarters (DOE)
ID	Idaho Operations
NPR	Naval Petroleum Reserves
NV	Nevada Operations
OK	Oakland Operations (California)
OFO	Ohio Field Office
ORO	Oak Ridge Operations
ORP	Office of River Protection
PA	Power Administrations ¹
PNR	Pittsburgh Naval Reactors Office
RF	Rocky Flats Operations
RL	Richland Operations
SNR	Schenectady Naval Reactors Office
SPR	Strategic Petroleum Reserves ²
SR	Savannah River Operations
YM	Yucca Mountain Site Characterization Project Office

Site or M&O contractor abbreviations:

ALA	Ames Laboratory
ANLW	Argonne National Laboratory, West
ANLE	Argonne National Laboratory, East
AEMP	Ashtabula Environmental Management Project
BAPL	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
ETTP	East Tennessee Technology Park
EML	Environmental Measurements Laboratory
FNAL	Fermi National Accelerator Laboratory
FEMP	Fernald Environmental Management Project
GJO	Grand Junction
HAN	Hanford Site ³
INEEL	Idaho National Engineering & Environmental Laboratory

1. Power Administration organizations are comprised of: the Alaska Power Administration (APA); the Bonneville Power Administration (BPA); Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA); and the Western Area Power Administration (WAPA).

² Strategic Petroleum Reserve Sites include: Bayou Choctaw, Big Hill, Bryan Mound and West Hackberry.

³ Hanford Site includes the Pacific Northwest National Laboratory

ITRI	Inhalation Toxicology Research Institute
KAPL	Knolls Atomic Power Laboratory
KCP	Kansas City Plant
KSO	Kesserling Site
LBL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratories
LANL	Los Alamos National Laboratories
MEMP	Miamisburg Environmental Management Project
MGN	Morgantown Federal Energy Technology Center
NREL	National Renewable Energy Laboratory ⁴
NRF	Naval Reactor Facilities
NTS	Nevada Test Site ⁵
NBL	New Brunswick Laboratory
ORISE	Oak Ridge-Institute of Science & Education
ORNL	Oak Ridge National Laboratories
PAN	Pantex Site
PGDP	Paducah Gaseous Diffusion Plant ⁶
PNL	Pacific Northwest Laboratory
PGH	Pittsburgh Federal Energy Technology Center
POR	Portsmouth Gaseous Diffusion Plant ⁴
PPPL	Princeton Plasma Physics Laboratory
ROSS	Ross Aviation, Inc.
SLAC	Stanford Linear Accelerator Center
SNLA	Sandia National Laboratories, Albuquerque
SNLL	Sandia National Laboratories, Livermore
SRS	Savannah River Site
TJNL	Thomas Jefferson National Accelerator Facility
WIPP	Waste Isolation Pilot Plant
WSS	Weldon Spring Site
WVDP	West Valley Demonstration Project
WS	Windsor Site
Y-12	Y-12 Plant
YM	Yucca Mountain Project

The below reference is used throughout the report to identify various DOE elements:

DOE field organization (abr.)/site (abr.)
Example: AL/LANL

⁴ National Renewable Energy Laboratory includes the Wind Site

⁵ Nevada Test Site Includes: Amador Valley Operations, Las Vegas Operations, Nevada-Los Alamos Operations, Nevada-Special Technology Laboratory, Washington Aerial Measurements Operation, and Nevada-EG&G Wolburn NV.

⁶ On July 1, 1993, a lease agreement took effect between the DOE and the United States Enrichment Corporation (USEC) essentially transferring all ownership responsibilities to USEC.

DEFINITIONS

The following terms are defined in the text of DOE Manual M 231.1-1, "Environment, Safety, and Health Reporting Manual." Major definitions not included in this manual have been extracted from the rescinded order DOE 5484.1 to clarify key concepts. Section references to these documents are given at the end of the definition.

1. **Property Value:** The approximate replacement value of all DOE-owned buildings and equipment. Included are the cost of all DOE-owned supplies and average inventory of all source and special nuclear materials. Excluded are the costs of land, land improvements (such as sidewalks or roads), and below ground facilities not susceptible to damage by fire or explosion (such as major water mains and ponds). (APPENDIX C, DOE M 231.1)
2. **Estimated Loss:** Monetary loss determination based on all estimated or actual costs to restore DOE property and equipment to preoccurrence conditions irrespective of whether this is in fact performed. The estimate includes: (1) any necessary nuclear decontamination; (2) restoration in areas that received water or smoke damage, (3) any reductions for salvage value, and (4) any lost revenue experienced as a result of the accident. The estimate excludes: (1) down time; and (2) any outside agency payments. Losses sustained on private property are not reportable, even if DOE is liable for damage and loss consequences resulting from the occurrence. Categorization of occurrences shall be by fire loss and non-fire loss events. (APPENDIX C, DOE M 231.1)
3. **Fire Loss:** All damage or loss sustained as a consequence of (and following the outbreak of) fire shall be classified as a fire loss. Exceptions are as follows: (1) burnout of electric motors and other electrical equipment through overheating from electrical causes shall be considered a fire loss only if self-sustained combustion exists after power is shut off. (APPENDIX C, DOE M 231.1)
4. **Non-fire Loss:** All damage or loss sustained as a consequence of the following events: (1) explosions; (2) natural cause events (such as earthquakes and hurricanes); (3) electrical malfunctions; (4) transportation (cargo) losses; (5) mechanical malfunctions; (6) radiation releases or other nuclear accidents; and (7) miscellaneous accidents (such as thermal, chemical or corrosion-related accidents). (CHAPTER 4.2.c, DOE 5484.1)
5. **Loss Rate:** Unit of comparison in cents loss per \$100 of property value.

EXECUTIVE SUMMARY

DOE experienced no fatalities or major injuries from fire in CY 2000. However, 127 fire events were reported during the period causing an estimated \$102,853,783 in property damage. These losses are approximately \$102,403,234 more than fire losses sustained in CY 1999, with 97 percent of loss attributed to 1 incident: the Cerro Grande Fire in Los Alamos, NM. This event is considered the most devastating monetary loss from fire in DOE history, and has resulted in our participation in a multi-agency review and update to the 1995 Federal Wildland Fire Management Policy. A key aspect of this policy states that every (wildland) area with burnable vegetation must have an approved Fire Management Plan that is based on the area's Land Management Plan. The DOE will most likely issue new policies or guidance that coordinates with the Federal Wildland Fire Management Policy.

Loss comparisons between the DOE and private industry are performed by normalizing data against total property value. In CY 2000 CAIRS reported a decrease in property valuations over the previous year by 8.1 percent to 102.5 Billion dollars. The CY 2000 fire loss rate is therefore approximately 10 cents for each \$100 in property value. This rate is 9.95 cents higher than the five year DOE average, and significantly more (9.39 cents) than private industry (non-nuclear) statistics.

Recurring costs for fire protection exceeded 131 million dollars in CY 2000. On a ratio of cost to total property value, the DOE spent approximately 12.86 cents per \$100 in property value for recurring fire protection activities or, 1.45 cents more than the previous year.

In CY 2000, 1 fire was controlled by automatic wet pipe sprinkler systems, continuing the DOE track record on sprinkler effectiveness at a 99 percent rate. The success of these fixed suppression systems were, however, offset by the inadvertent actuation of 38 systems primarily due to unspecified causes. Also, concerns remain regarding inadvertent Halon discharges (7 of the above 38 events), causing the release of approximately 1338 pounds of Halon to the environment. DOE remains committed to minimizing this ozone depleting substance through implementation of its managed Halon phase out guidelines.

DOE PROPERTY LOSS EXPERIENCE

Property value estimates are taken from the CAIRS database and serve as a common denominator for comparing Annual Summary loss rates to the CAIRS Summary. CAIRS data shows that DOE property values decreased approximately 8.1 percent in CY 2000.

In all, 127 fire incidents were reported by field organizations accounting for a total year-end fire loss of \$102,853,783. Of these incidents, 107 fires were reported as falling below the CAIRS threshold of \$5,000. Field organizations reported through CAIRS, non-fire loss amounts totaling \$312,839.

Fire Protection Summary
For Calendar Year 2000

DOE's fire loss rate for CY 2000, as summarized from field organization reports, is approximately 10.03 cents loss per \$100 property value; 245 times higher than last year's 0.04 cent figure. This statistic is also 127 times higher than the 1995-1999 DOE average of 0.08, starting an upward trend in fire loss rates over previous years. By comparison, the five-year loss rate average for the highly protected risk (HPR) insurance industry was about 0.64 cents per \$100 value⁷.

Table 1 characterizes Annual Summary loss histories since 1950 and includes both fire and non-fire loss rate categories. Numbers shown in parentheses represent a 5-year running average, where applicable. The accompanying figures are described as follows:

Figure 1 - graphical representation of the Department's property valuation since 1950

Figure 2 - fire and non-fire property loss since 1980

Figure 3 - fire loss rates since 1985

Figure 4 - non-fire loss rates over the same time period

Figure 5 - the current year's fire event tally by Field Organizations

Figure 6 - the current year's fire loss (dollars) by Field Organizations

Figure 7 - the current year's fire loss rate by Field Organizations

Figure 8 - the current year's non-fire event tally by Field Organizations

Figure 9 - the current year's non-fire loss (dollars) by Field Organizations

Figure 10 - the current year's non-fire loss rate by Field Organizations

Organizations not shown on Figures 5 through 10 reported either insignificant or zero losses for the year.

Trending of fire loss data indicates that a small number of incidents constitute the majority of dollar losses reported to the DOE. For example, the largest fire incident accounted for approximately 97 percent of the total dollar loss amount.

The largest fire and non-fire losses for the year are noted below:

1. AL/LANL - Cerro Grande Fire, ORPS N0.: LANL-2000-0003. On May 4, 2000 the National Park Service conducted a prescribed fire on Cerro Grande Peak, approx. 5 miles Southwest of LANL's southern boundary. This burn was conducted with the intent to remove severe pine litter and destroy heavy understory in what was traditionally a mixed conifer area. On May 5th, the fire escaped the borders of the prescription area and began moving both north and northwest on two separate fronts, reaching LANL's western boundary on May 7th. A Non-emergency Significant Event was declared at 1515. An Environmental Operational Emergency was declared at 1845. LANL ceased all operations effective Monday, May 8th. Most LANL operations would remain closed for more than two weeks. On Wednesday, May 10th, the fire moved into LANL operated property and continued to move both to the north and east. Final containment was achieved on May 22nd.

⁷. As reported by an HPR insurance company for standard business property loss from fires and explosions (1997).

During this event the Laboratory suffered the loss of 52 structures. These structures were of a temporary nature (trailers and transportables), or were permanent structures that were already scheduled for Decontamination and Decommissioning (D&D). No critical structures were lost. Most LANL owned or operated facilities received some level of damage. Damage in most cases was minimal, with smoke damage, and clogged filters being the most common type of damage. At this time, no quantifiable dollar loss exists. Estimates range to the one billion-dollar mark, based on lost work time, programmatic interruption, the loss of several years of research that was not backed up prior to a building being consumed and the on going recovery and mitigation activities. Property Loss value assigned - \$100,000,000.

2. OFO/FEMP – Demolition Project was performing demolition of the 20H Site Water Tank, a large concrete tank that had been part of the former Water Treatment Plant. A trackhoe with a 360-degree rotating excavator shear attached was being used to demolish the tank. When the operator started up the trackhoe and proceeded to raise the boom, the jaw section of the shear broke off from head where the slew ring is attached to the back plate. When the jaw section fell over onto the ground, it pulled out a hydraulic fluid line. Damage estimate - \$49,070.

The 2000 fourth quarter CAIRS report identified 7 fire incidents over the year resulting in a loss of \$102,236,640; approximately \$617,000 less than the Annual Summary. Most of this difference can be traced to a large number of incidents (15) that were not incorporated into the CAIRS database. The CAIRS report also lists 23 non-fire incidents producing losses of \$312,839. ORPS identifies a total of 51 fire events over CY 2000 in which fire exceeded the minimum 10- minute reporting threshold.

This report has historically identified discrepancies between Annual Summary field reports and that of either CAIRS or ORPS databases. In many instances, these discrepancies were traced to either: reporting threshold differences, delayed reporting, cost estimating differences, improper loss characterization, or a misinterpretation on the need to file a report at all. Since loss statistics from CAIRS and ORPS are often extracted for use in other documents such as reports to Congress, performance indicator studies, and media releases, an incomplete reflection of DOE fire loss history is often the result. Database administrators are addressing these issues by increased field training programs and by streamlining the reporting process using state of the art electronic technology. A part of this technology includes developing a "seamless" approach using a library of definitions that allows the sharing of data across multiple database applications.

Fire Protection Summary
For Calendar Year 2000

Table 1
DOE Loss History From 1950 To Present

Year	Property Value (Millions of Dollars)	Fire Loss (Dollars)	Non-fire Loss (Dollars)	Loss Rates (cents per 100 Dollar Value)		
				Fire*	Non-Fire*	Total*
50	1,800.00	486,389	10,050	2.70 -	0.06 -	2.76 -
51	2,177.10	38,318	317,797	0.18 -	1.46 -	1.64 -
52	3,055.10	449,107	356,600	1.47 -	1.17 -	2.64 -
53	4,081.00	148,142	427,430	0.36 -	1.05 -	1.41 -
54	6,095.90	185,438	190,436	0.30 -	0.31 -	0.62 -
55	6,954.20	125,685	330,103	0.18 (1.00)	0.47 (0.81)	0.66 (1.81)
56	7,364.10	2,206,478	940,945	3.00 (0.50)	1.28 (0.89)	4.27 (1.39)
57	7,973.20	590,663	885,936	0.74 (1.06)	1.11 (0.86)	1.85 (1.92)
58	8,102.50	275,560	476,265	0.34 (0.92)	0.59 (0.84)	0.93 (1.76)
59	10,301.80	199,841	998,060	0.19 (0.91)	0.97 (0.75)	1.16 (1.67)
60	10,708.60	636,228	764,823	0.59 (0.89)	0.71 (0.88)	1.31 (1.77)
61	11,929.90	325,489	5,530,566	0.27 (0.97)	4.64 (0.93)	4.91 (1.91)
62	12,108.80	3,020,023	293,341	2.49 (0.43)	0.24 (1.60)	2.74 (2.03)
63	13,288.90	599,056	776,998	0.45 (0.78)	0.58 (1.43)	1.04 (2.21)
64	14,582.80	480,519	870,516	0.33 (0.80)	0.60 (1.43)	0.93 (2.23)
65	15,679.30	1,743,448	2,106,621	1.11 (0.83)	1.34 (1.35)	2.46 (2.18)
66	16,669.00	158,220	698,753	0.09 (0.93)	0.42 (1.48)	0.51 (2.41)
67	17,450.90	359,584	2,423,350	0.21 (0.90)	1.39 (0.64)	1.59 (1.53)
68	18,611.90	155,986	713,097	0.08 (0.44)	0.38 (0.87)	0.47 (1.31)
69	20,068.30	27,144,809	909,525	13.53 (0.37)	0.45 (0.83)	13.98 (1.19)
70	22,004.30	89,456	1,611,336	0.04 (3.00)	0.73 (0.80)	0.77 (3.80)
71	24,155.80	78,483	1,857,566	0.03 (2.79)	0.77 (0.68)	0.80 (3.47)
72	26,383.50	222,590	698,061	0.08 (2.78)	0.26 (0.75)	0.35 (3.52)
73	27,166.70	117,447	2,258,241	0.04 (2.75)	0.83 (0.52)	0.87 (3.27)
74	28,255.50	249,111	930,766	0.09 (2.75)	0.33 (0.61)	0.42 (3.36)
75	31,658.30	766,868	4,485,481	0.24 (0.06)	1.42 (0.59)	1.66 (0.64)
76	35,512.70	251,849	2,040,727	0.07 (0.10)	0.57 (0.72)	0.65 (0.82)
77	39,856.10	1,084,823	2,529,161	0.27 (0.11)	0.63 (0.68)	0.91 (0.79)
78	47,027.10	12,976,036	4,501,943	2.76 (0.14)	0.96 (0.76)	3.72 (0.90)
79	50,340.80	654,716	1,886,307	0.13 (0.69)	0.37 (0.78)	0.50 (1.47)
80	54,654.70	1,385,686	7,160,249	0.25 (0.69)	1.31 (0.79)	1.56 (1.49)
81	59,988.80	2,042,633	2,600,855	0.34 (0.70)	0.43 (0.77)	0.77 (1.47)
82	65,360.40	948,691	3,252,277	0.15 (0.75)	0.50 (0.74)	0.64 (1.49)
83	70,484.40	731,234	9,765,828	0.10 (0.73)	1.39 (0.71)	1.49 (1.44)
84	82,166.90	1,549,807	4,917,513	0.19 (0.19)	0.60 (0.80)	0.79 (0.99)
85	86,321.84	1,145,975	2,983,322	0.13 (0.21)	0.35 (0.85)	0.48 (1.05)
86	82,787.52	805,030	4,490,262	0.10 (0.18)	0.54 (0.65)	0.64 (0.83)
87	91,927.20	1,570,736	1,440,093	0.17 (0.13)	0.16 (0.67)	0.33 (0.81)
88	92,998.00	466,120	7,837,000	0.05 (0.14)	0.84 (0.61)	0.89 (0.74)
89	107,948.00	615,551	6,890,000	0.06 (0.13)	0.64 (0.50)	0.70 (0.63)
90	115,076.00	8,392,746	9,078,000	0.73 (0.10)	0.79 (0.51)	1.52 (0.61)
91	118,868.68	608,740	1,820,065	0.05 (0.22)	0.15 (0.59)	0.20 (0.81)
92	118,267.06	1,166,858	2,486,696	0.10 (0.21)	0.21 (0.52)	0.31 (0.73)
93	119,826.25	679,939	2,338,595	0.06 (0.20)	0.19 (0.53)	0.25 (0.73)
94	124,350.29	1,533,717	1,869,933	0.12 (0.20)	0.15 (0.40)	0.27 (0.60)
95	120,321.68	720,720	911,746	0.06 (0.21)	0.08 (0.30)	0.14 (0.51)
96	113,471.00	2,372,482	3,653,350	0.21 (0.08)	0.32 (0.16)	0.53 (0.24)
97	102,947.24	544,924	5,567,963	0.05 (0.11)	0.54 (0.19)	0.59 (0.30)
98	99,127.79	316,475	1,062,313	0.03 (0.10)	0.11 (0.26)	0.14 (0.36)
99	110,858.47	450,549	2,467,991	0.04 (0.10)	0.22 (0.24)	0.26 (0.34)
00	102,514.01	102,853,783	312,839	10.03 (0.08)	0.03 (0.25)	10.06 (0.33)

*Numbers shown in parentheses represent the 5-year running average.

Figure 1
DOE Property Valuation

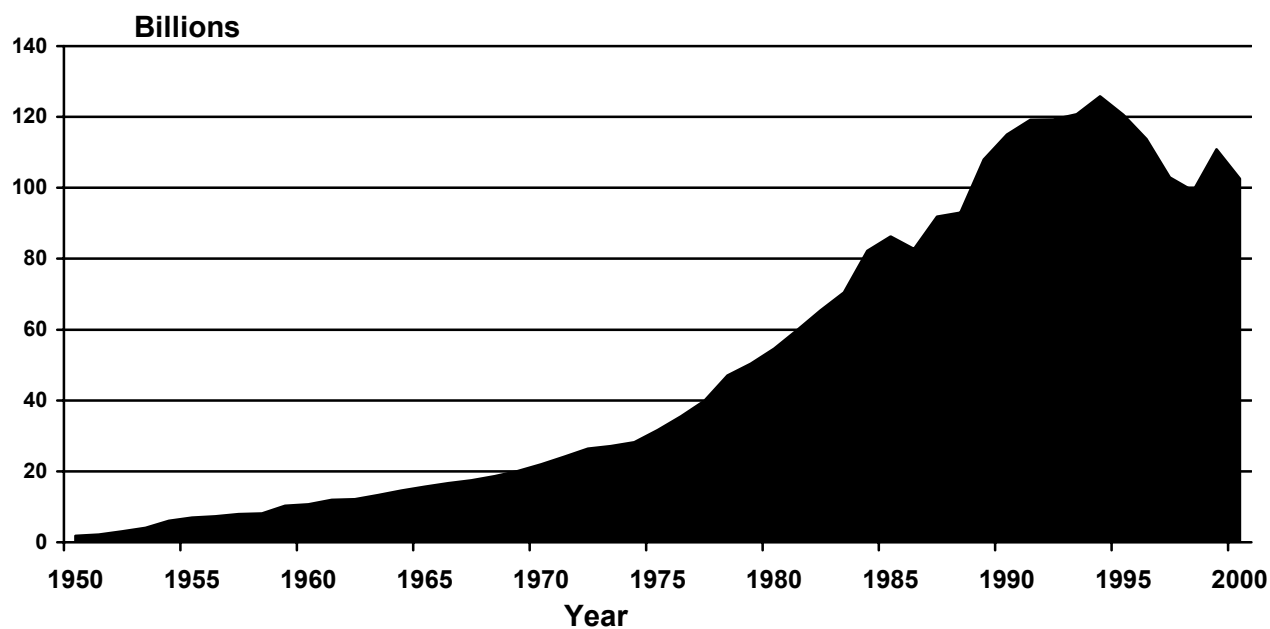


Figure 2
Property Loss

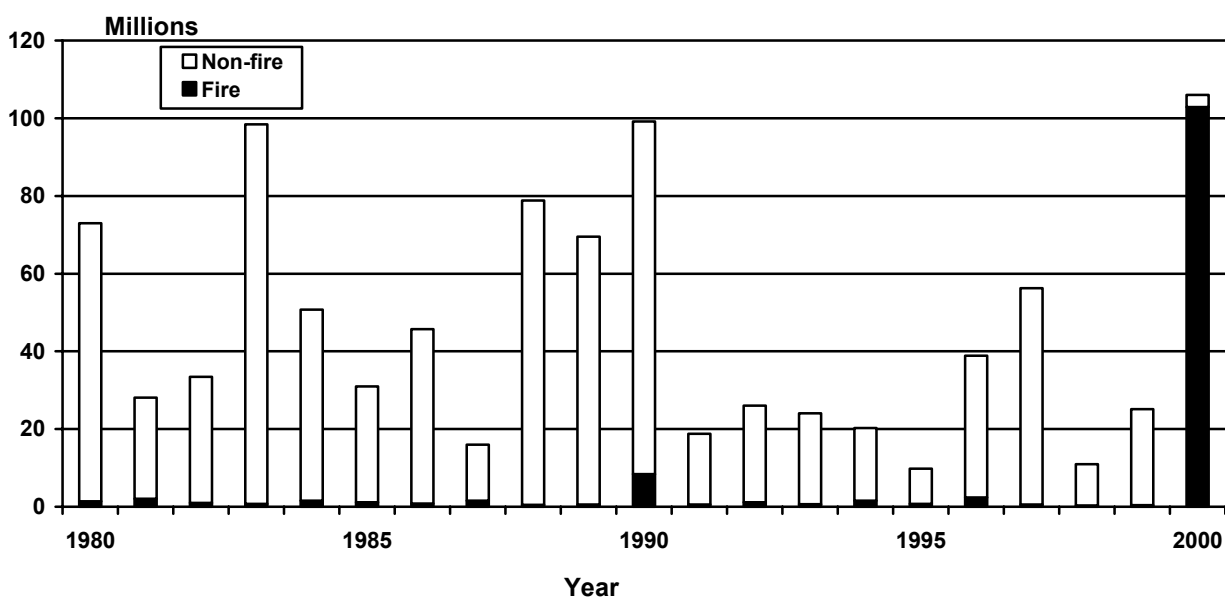


Figure 3
DOE Fire Loss Rate

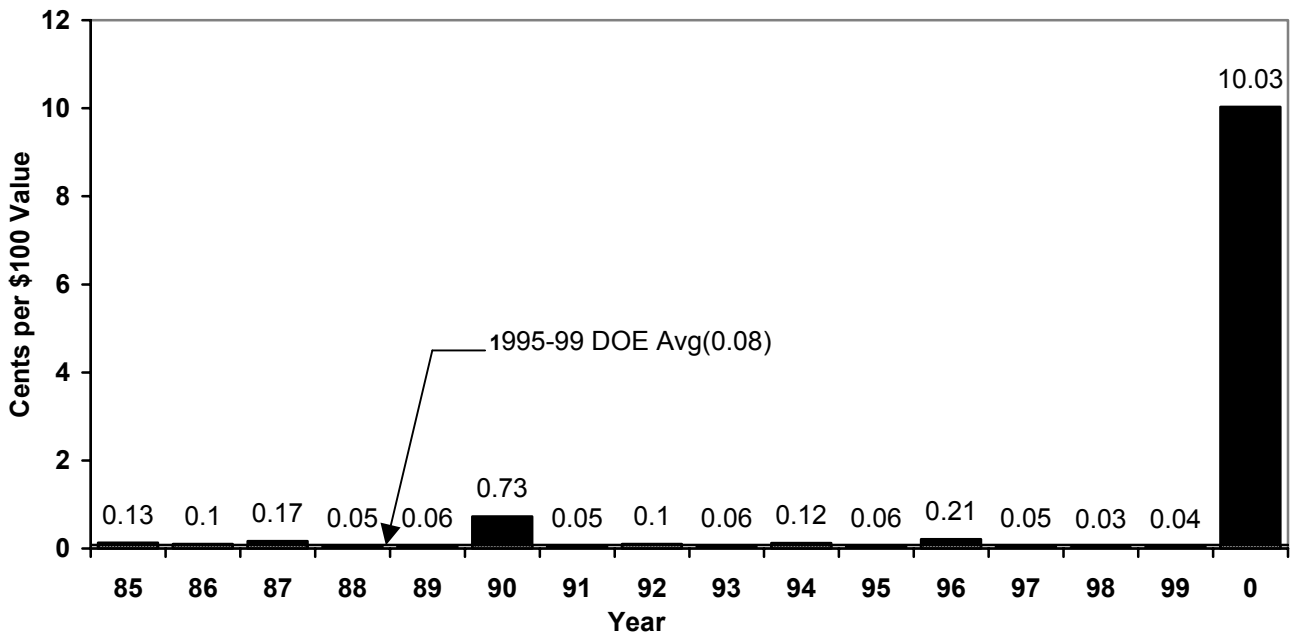


Figure 4
DOE Non-fire Loss Rate

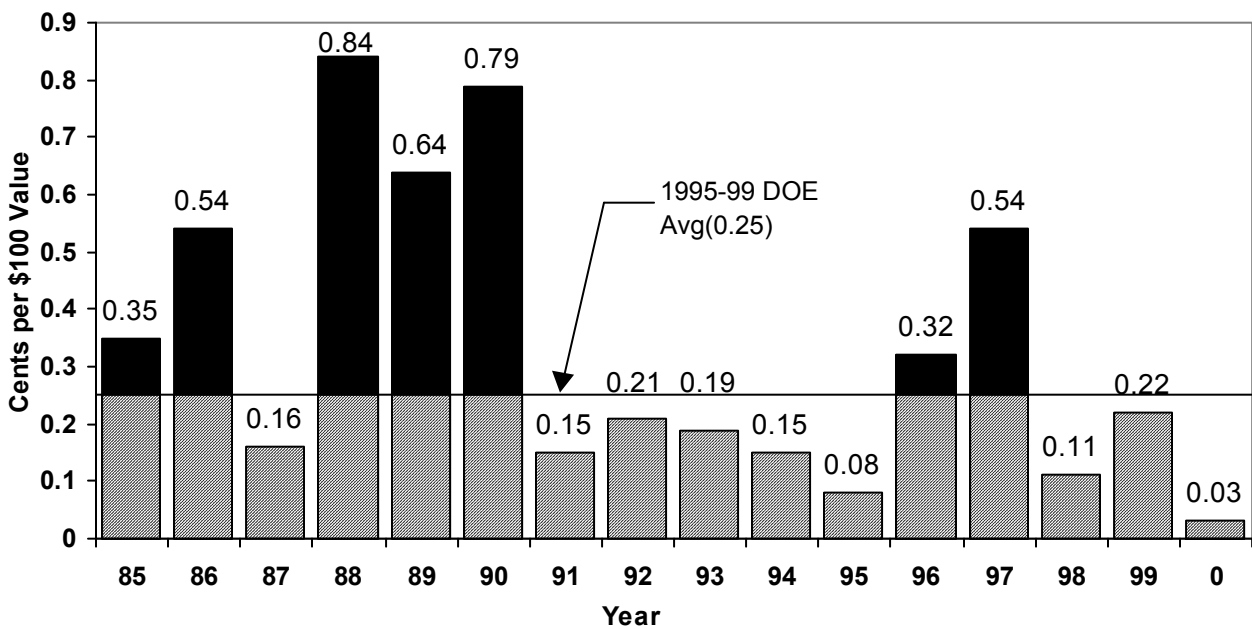


Figure 5
Fire Events by Field Organization

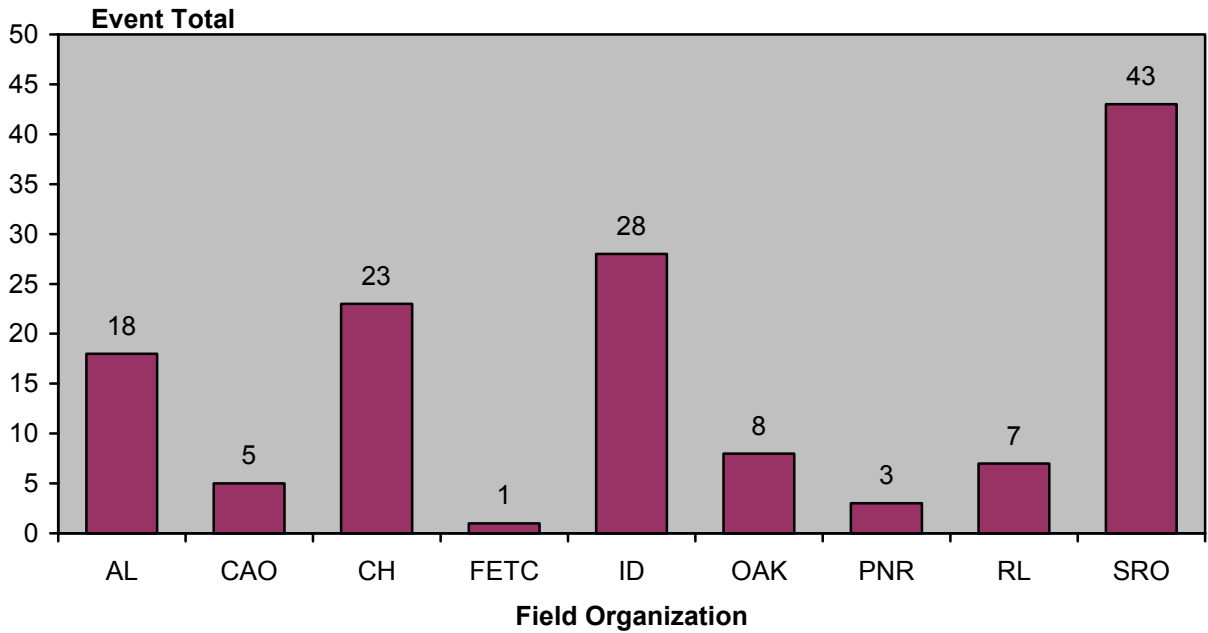


Figure 6
Fire Loss Amount by Field Organization

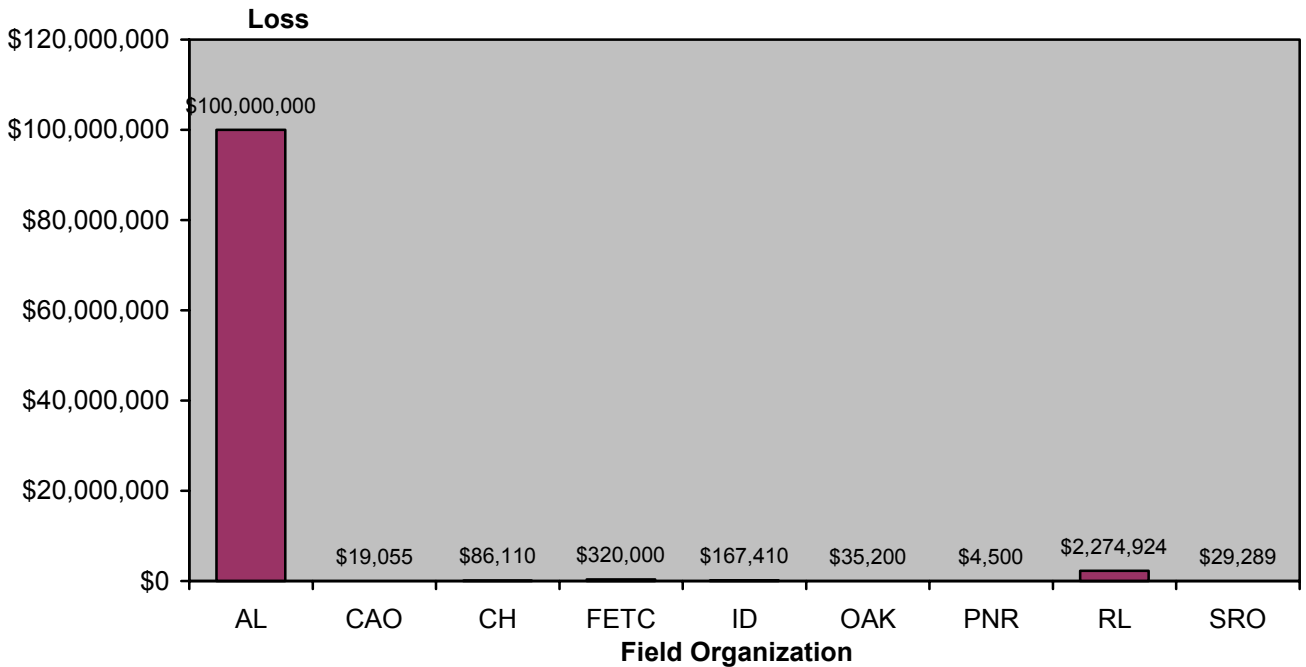


Figure 7
Fire Loss Rate by Field Organization

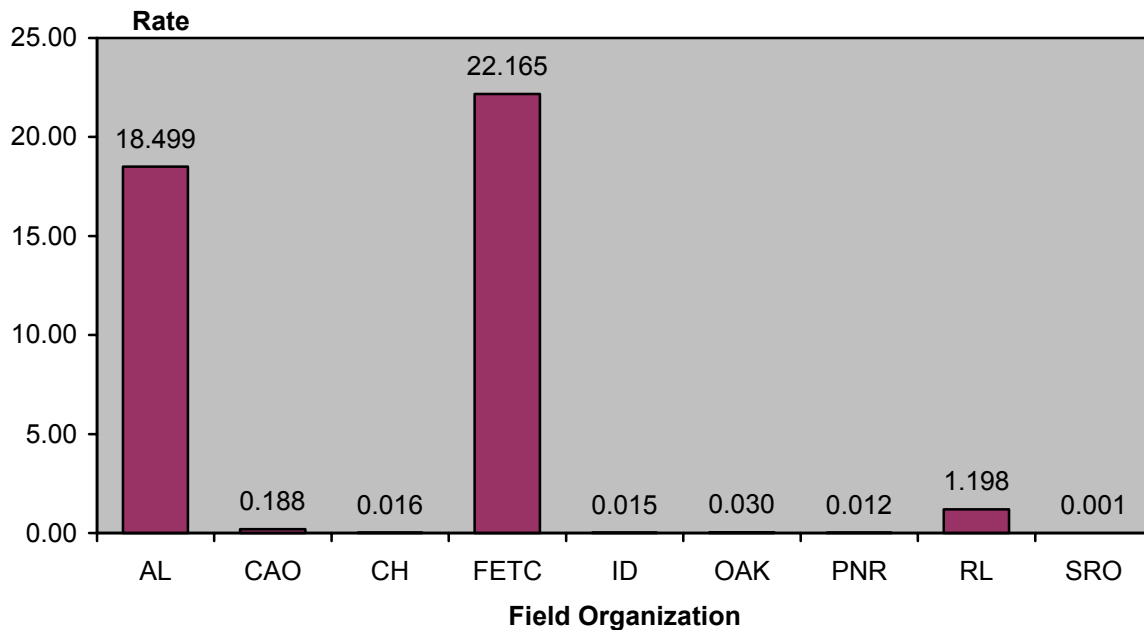


Figure 8
Non-fire Loss Events by Field Organization

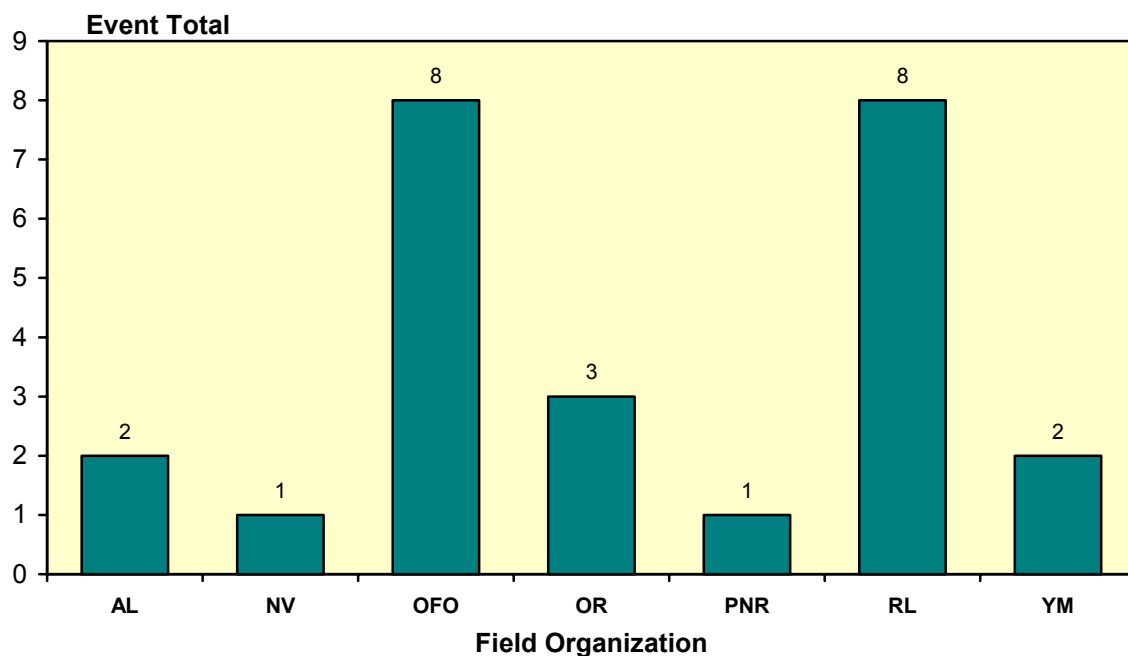


Figure 9
Non-fire Loss Amount by Field Organization

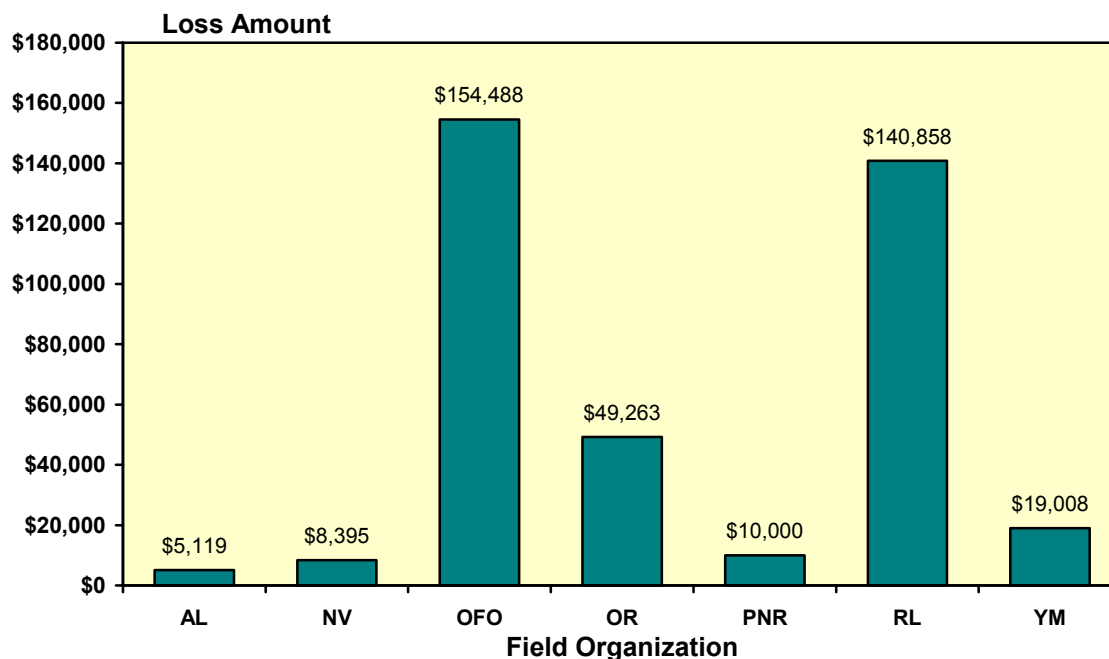
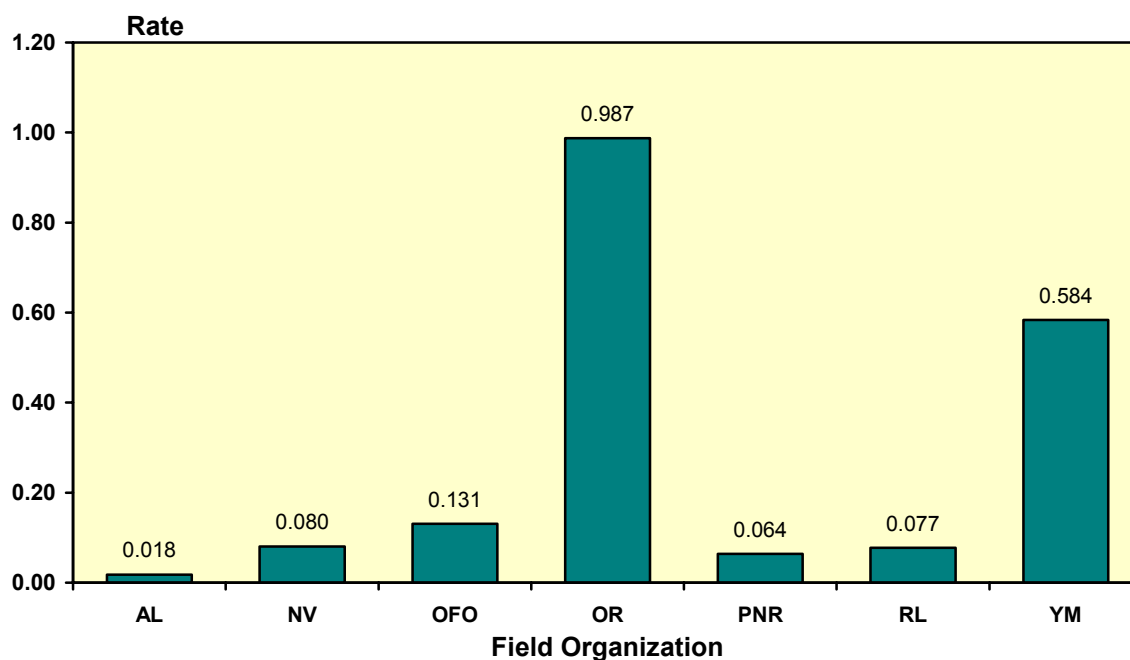


Figure 10
Non-fire Loss Rate by Field Organization



SUMMARY OF FIRE DAMAGE INCIDENTS

The following table provides a brief description notable DOE fire losses over the year:

Table 2: Summary of Fire Damage Incidents			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Fire/Smoke (Brush)	AL / LANL	Cerro Grande Fire, ORPS LANL-2000-0003.	\$100,000,000.00
Fire/Smoke (Brush)	RL / HAN	A wildland fire initiated from a motor vehicle accident on State Highway 24 and entered the Hanford Site burning approximately 163, 000 acres of federal, state, and private land before being extinguished. A road grader, a 1-ton fire department brush truck, a drain field, and native plants were damaged as a result of the fire. (Command 24 Range Fire).	\$2,107,846.00
Fire/Smoke (Building)	FETC / MGN	Fire damaged an office trailer located at the NETL Morgantown, WV site. At the time of the incident, the modular unit provided office space for fifteen contractor and federal employees. The trailer and contents were a total loss. The fire originated inside an interior partition and was caused by an electrical short in a fluorescent lighting circuit	\$320,000.00
Fire/Smoke (Brush)	RL / HAN	The Command 24 Wildland Fire damaged Environment Restoration Contractor equipment including radiation signs and fencing.	\$94,700.00
Fire/Smoke (Other)	CH / BNL	On March 11, 2000 a fire occurred at a waste-staging area associated with the Chemical/Glass Holes Project at Brookhaven National Laboratory. The waste included low level radioactive soil and processed (shredded) debris, which was stored in Soft Sided Lift Liner" containers. Thirty-two lift liner containers, made of light density polypropylene, containing these wastes were involved in the fire. The plastic lift liner containers and the polyethylene coverings were the primary fuel. Burning pieces of straw most likely ignited the plastic sacks. The warm spring day in March accelerated bacterial action within the straw, generating sufficient heat to spontaneously combust. Combustible straw had been allowed to enter the waste stream without the hazards being identified and controls implemented. Direct property loss (sacks, polyethylene cover) is estimated at under \$17,200. The costs of the repackaging and analysis were \$10,000. Investigation costs are estimated at \$10,000. The costs of emergency response (Radiological Control Technician, Fire/Rescue, and Analytical Services) are estimated at \$33,000.	\$70,000.00
Fire/Smoke (Brush)	ID / INEEL	Total of 6 BLM air drops, no other BLM support --- 50,000 acres caused by lightning.	\$58,000.00
Fire/Smoke (Building)	RL / HAN	A 115 kV transformer failed internally causing a phase-to-ground fault. The unit exploded igniting the mineral oil contents and the fire department responded to the scene and extinguished the fire.	\$37,734.00

Fire Protection Summary
For Calendar Year 2000

Table 2: Summary of Fire Damage Incidents			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Fire/Smoke (Vehicle)	OAK / LLNL	4-WD vehicle stuck in soft soil and dry grass adjacent to unpaved fire trail. The grass ignited by a hot muffler. Log Number: 2000-0004038	\$23,700.00
Fire/Smoke (Brush)	RL / HAN	The wildland fire (Command 24 Wildland Fire) damaged five Hanford Meteorological Network stations operated by Battelle Memorial Institute (PNNL).	\$18,110.00
Fire/Smoke (Building)	CAO / WIPP	On October 23, 2000 a fire occurred at Substation #3 at the WIPP surface. The Facility Shift Manager had power isolated to the substation and the blaze extinguished. The fire occurred in a busway due to water migration from heavy rain causing arcing and the meltdown of the copper busway bar.	\$16,000.00
Fire/Smoke (Vehicle)	SRO / SRS	At 13:15, SRSFD personnel were dispatched to a call-in van fire (Ford Van, GSA Tag # G4359684) on Highway #125. A WSRC van leased by SUD was on the power line right-of-way checking conditions when the vehicle bogged down causing exhaust to ignite grass/brush. The vehicle was totally involved upon FD arrival. Attempts with a portable extinguisher prior to FD arrival were ineffective. FD contained the fire around the van then began attack on van. The fire was under control when forestry arrived but BC asked them to apply foam to complete extinguishment. Forestry applied 300 gallons of water with Class A foam. There were no injuries and costs incurred totaled \$15,000.	\$15,000.00
Fire/Smoke (Building)	SRO / SRS	At 11:32, SRSFD personnel were dispatched to 105-K based on a call-in alarm from facility personnel. The fire was reported in Transformer Rm. #2. Upon arrival, facility personnel had extinguished the fire with an extinguisher. SRSFD firefighters investigated and found the cause of the fire to be an electrical short in Panel 26 E-1. There were no injuries and the estimate for damage is \$10,000.	\$10,000.00
Fire/Smoke (Brush)	ID / INEEL	BLM support --- 8,000 acres caused by lightning	\$9,280.00
Fire/Smoke (Building)	RL / HAN	A 1500 kVA dry type outdoor transformer failed causing internal plastic components to ignite. The fire department responded and extinguished the fire.	\$9,197.00
Fire/Smoke (Building)	ID / INEEL	A wall mounted heating unit was installed with inadequate clearance. This caused ignition of the combustible wall and roof framing.	\$7,000.00
Fire/Smoke (Brush)	ID / INEEL	BLM support --- 5,400 acres caused by lightning	\$6,275.00
Fire/Smoke (Building)	CH / ANLE	Argonne FD firefighters responded to the fire alarm in Facility 549. Firefighters opened the building and entered to moderate smoke that filled the structure. Incident Command coordinated with Linemen crews to secure the power and identify that a transformer had burned.	\$6,000.00
Fire/Smoke (Building)	RL / HAN	A duct heater overheated and resulted in a fire when belts and filters stored on top of the duct caught fire. The Hanford Fire Department extinguished the fire with water. The fire did not activate fire sprinklers in the area. CAIRS No. 20000035	\$5,337.00
Fire/Smoke	OAK / LBL	An electrician discovered a short and a fault might have	\$5,000.00

Fire Protection Summary
For Calendar Year 2000

Table 2: Summary of Fire Damage Incidents			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
(Building)		caused the power to trip in a classroom. Upon investigation, a fire was detected at the distribution panel.	
Fire/Smoke (Building)	CH / BNL	During a test of an emergency generator, the voltage controller failed. Voltage above design was supplied to the building, causing various electrical components to smoke. Incident Report Number: 000126	\$5,000.00

WATER-BASED AUTOMATIC SUPPRESSION SYSTEM PERFORMANCE

A total of 29 incidents were reported where water-based suppression systems operated in CY 2000: 11 were wet-pipe systems, 4 dry-pipe, 11 deluge, 2 foam, and 1 preaction. Of the wet-pipe system activations, one event was directly related to fire. Other system activations were caused by the following events: employee related (6), design/material related (6), unspecified/other (16).

Water-based system activations of interest are listed in Table 3.

Table 3: Water Based System Actuations			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Fire/Smoke (Building)	SNR / KAPL	A combination air conditioner/dehumidifier incurred an electrical short. The unit caught fire which caused the sprinkler system to operate and contain the fire to the room and contents. A manual fire extinguisher was also used to control the fire inside the units electrical system.	\$0.00
Release	OAK / LLNL	Sprinkler head actuation due to a head defect.	\$20,000.00
Release	OFO / FEMP	Sprinkler system actuated due to low air in the system. Upon arrival of the site Fire Department, an investigation was conducted and found that human error was to blame for the low air. Fire Protection was not notified of a low air signal that occurred earlier in the day. The Communications Center made the call but personnel working on another system acknowledged the call for the low air signal and the information was not given to the Emergency Chief. The system was reset and put back in service within 20 minutes.	\$0.00
Release	CH / ANLE	Argonne FD firefighters responded to the Building 331 Radioactive Waste Storage Facility for an activated sprinkler alarm. Firefighters found a broken sprinkler pipe and water flowing as a result. Firefighters secured the OS&Y valve to control the system leak. Incident Command transferred the incident to Waste Management for cleanup. The sprinkler system was returned to service after repairs.	\$0.00
Release	CH / ANLE	Argonne FD firefighters responded to a sprinkler alarm in Building 362 and discovered that a steam leak had occurred and caused the sprinkler head to open. Sprinkler water spraying on fire detection devices had caused other alarm interference within the building. After securing the sprinkler system, FD Command verified that an asbestos hazard	\$0.00

Table 3: Water Based System Actuations			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
		existed, and cordoned off the suspected areas. FD personnel coordinated with PFS-BM, ESH-HIS, Waste Management, Emergency Management and building management. After some emergency fire protection repairs were completed, the sprinkler system was restored later that day.	
Release	AL / LANL	Approximately 9,000 gallons of fire suppressant foam (3% AFFF) was released and was caused by a low nitrogen condition on the open head deluge foam water sprinkler system. The release had a slight impact on a Solid Waste Management Unit in Ten Site Canyon. ORPS Report No.: PHYSCOMPLX-2000-0001.	\$0.00
Release	OR / Y-12	9409-26 Deluge System 1 - Mechanical. Compressor failure.	\$0.00
Release	OR / Y-12	Deluge System 7 - Low Air	\$0.00
Release	OR / Y-12	Deluge System 1 - Mechanical. Diaphragm failure	\$0.00
Release	OR / Y-12	Deluge System 7 - Low Air	\$0.00
Release	OR / Y-12	Deluge System 1 - Undetermined Cause	\$0.00
Release	OR / Y-12	Dry Pipe System 1 - Mechanical. Air compressor failure	\$0.00
Release	OR / Y-12	Deluge System 1 - Low Air	\$0.00
Release	CH / ANLE	Argonne FD firefighters responded to Building 460 for an activated sprinkler alarm. A broken sprinkler pipe in the laundry chute caused the water flow. Firefighters secured the OS&Y valve and initiated immediate inspections of the area for water damage. Firefighters assisted with the initial water cleanup efforts using water vacs and squeegees until transferring the incident to the Marriott building management.	\$0.00
Release	OR / Y-12	Dry Pipe System 1 – Human Error. Low Air During Power Outage	\$0.00
Release	CH / W	Sprinkler main flow	\$0.00
Release	OR / Y-12	Dry Pipe System 1 - Mechanical. Air regulator on air bottle	\$0.00
Release	OR / Y-12	Deluge System 1 - Low Air	\$0.00
Release	OR / Y-12	Preaction System 1 – Low Air	\$0.00
Release	OR / Y-12	Wet Pipe System 9 - Sprinkler Head Actuated - No Apparent Reason	\$0.00
Release	OR / Y-12	Deluge System 7 - Undetermined Cause	\$0.00
Release	OR / Y-12	Deluge System 8 - Undetermined Cause	\$0.00
Release	OR / Y-12	Wet Pipe System 1 – Human Error. Low Antifreeze solution.	\$0.00
Release	OR / Y-12	9720-45 Foam Water System 1-Human Error. Did not respond to low air alarm	\$0.00
Release	RL / HAN	A deluge system protecting an exterior transformer inadvertently discharged. The contractor took the system out of service. After the discharge an engineering review determined that this system was no longer necessary.	\$0.00
Release	RL / HAN	While working on the overhead doors, a branch line to the sprinkler system was inadvertently broken. The system was restored to service.	\$0.00
Release	CH / W	Sprinkler main flow	\$0.00
Release	CH / W	Sprinkler main flow	\$0.00

Table 3: Water Based System Actuations			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Release	OR / Y-12	Deluge System 7W - Mechanical. Diaphragm failure	\$0.00

There are now a total of 240 incidents in DOE records where water based extinguishing systems operated in a fire. The satisfactory rate of performance is 99.2 percent, or 238 times out of 240 incidents. The two failures during a fire were attributed to; a closed cold weather valve in 1958 controlling a single sprinkler in a wood dust collector and, a deluge system failure due to a hung-up trip weight in a 1963 transformer explosion.

From the above history, DOE has experienced 112 fires that were either controlled or extinguished by the wet-pipe type of automatic suppression system. Table 4 below provides a summary on the number of sprinklers actuated to control or extinguish a fire against the number of occurrences where this event was reported. For example: 95 percent of these fires were controlled or extinguished with 4 or less sprinklers activating, 91 percent were controlled with 3 or less sprinklers activating, and so on.

The significance of this table is to highlight actual performance on systems that have been installed according to standard design practices (in this case the National Fire Protection Association (NFPA) Standard 13, Installation of Sprinkler Systems). By comparing the actual performance to design requirements, the designer or reviewer can get a sense of the conservativeness of the design requirement and adjust the design where necessary. Sprinkler system water containment, for example, could rely on actual performance rather than strict design practice, since no specific design criteria exist on the subject.

Table 4
**DOE Wet-Pipe Automatic Suppression Performance
1955 to 2000**

Number of Sprinklers Activated per Fire Event	Number of Events	Cumulative Total of Events	Percentage of Event	Cumulative Percentage of Events
1	79	79	71	71
2	18	97	16	87
3	5	102	5	91
4	4	106	4	95
5	2	108	2	96
6	1	109	1	97
7	2	111	2	99
8	0	111	0	99
9+	1	112	1	100

NON WATER-BASED FIRE SUPPRESSION SYSTEM PERFORMANCE

Concerns regarding the effect of chlorinated fluorocarbons (CFCs) and Halon on the ozone layer have led to their regulation under the 1991 Clean Air Act. The Environmental Protection Agency has subsequently published rules on this regulation to include; prohibiting new Halon production, establishing container-labeling requirements, imposing Federal procurement restrictions, imposing significant Halon taxes, issuing requirements for the approval of alternative agents, and listing essential areas where Halon protection is considered acceptable.

DOE's current policy does not allow the installation of any new Halon systems. Field organizations have been requested to aggressively pursue alternative fire suppression agents to replace existing systems and to effectively manage expanding Halon inventories. The long-term goal is the gradual replacement of all Halon systems.

In CY 2000, the DOE had 580 Halon 1301 systems in operation containing approximately 161,142 pounds of agent. Stored Halon 1301 inventory was reported at approximately 136,701 pounds⁸. Operational and stored inventory amounts for the Halon 1211 were reported at 97,812 and 18,441 pounds, respectively.

Field organizations reported that 34 non-essential systems have been disconnected in 2000, adding approximately 10,306 pounds to DOE's inventory.

Table 5 provides a breakdown of the five largest Halon utilizing field organizations, listing both Halon 1301 (fixed system extinguishing agent) and Halon 1211 (portable extinguishing agent). Agent Drawdown amount represents the Halon released to the environment over the calendar year. The bulk of Halon utilized within the Power Administrations⁹ is located at WAPA.

Table 5
Primary DOE Sites Utilizing Halon Suppression Systems

LOCATION	HALON 1301		AGENT DRAWDOWN	HALON 1211	
	ACTIVE (lbs.)	INVENTORY (lbs.)		ACTIVE (lbs.)	INVENTORY (lbs.)
SR*	40,897	34,348	312	2723	803
AL	31,276	32,174	0	46,294	4,992
CH	34,432	23,137	590	18,415	206
PA	10,828	2,331	0	2,155	0
SPR	9,748	0	0	0	0
Total	127,181	91,990	902	69,587	6,001

⁸ Amount excludes banked inventory at the SRS – 59,121 pounds Halon 1301, 85,770 pounds Halon 1211.

⁹ In CY 1996, BPA ceased reporting any losses according to DOE O 231.1. Last known Halon amounts for the BPA were 14,495 lbs. in 6 systems and are not reflected in the current DOE totals.

Fire Protection Summary
For Calendar Year 2000

* Designated as DOE's Halon bank.

A total of 10 incidents were reported at DOE where Halon 1301 or other non-water based suppression systems operated in CY 2000. No sites reported any system failures during a fire. Additionally, approximately 1,338¹⁰ pounds of Halon 1301 were released in these events. A brief description of non-water based suppression system actuations is provided in Table 6 below.

Table 6: Non Water Based System Actuations			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Fire/Smoke (Vehicle)	CAO / WIPP	A fire occurred in the underground involving a haul truck. The fire was caused by hot work activities for repairs to the vehicle. Sparks caused by a cutting torch ignited oily residues that had accumulated on the frame of the vehicle. The automatic dry chemical suppression system discharged and extinguished the fire. There was no vehicle damage.	\$2,555.00
Fire/Smoke (Building)	PNR / BAPL	A unit heater failed causing a fire and smoke in the facility. Smoke actuated the room's smoke detection system and caused the Halon to discharge below the raised floor area.	\$2,500.00
Fire/Smoke (Other)	CAO / WIPP	A fire occurred in the underground when a milling machine caught fire. The fire ignited in the engine compartment during normal operations. The cause was determined to be a hydraulic leak that sprayed onto the manifold/turbocharger causing ignition. The automatic dry chemical suppression system discharged and extinguished the fire. No damages were reported to the vehicle.	\$500.00
Fire/Smoke (Building)	CH / BNL	Building occupant (AGS operator) smelled smoke. Pulled fire alarm box. Fire Alarm Panel failed. Operator pulled a Halon discharge station, discharging 590 pounds of halon. Still no alarm was transmitted, so a call was placed to 911. The fire origin was found the next day at an electrical motor control panel. A short in the panel caused an overload. Sparks from the overload ignited a 55-gallon bag of garbage in front of the motor control center. No further damage occurred. Incident Report Number: 000302	\$500.00
Fire/Smoke (Building)	OAK / SLAC	Failure of the UPS system actuated the FM-200 system.	\$0.00
Release	SNR / KAPL	Knolls site experienced a halon system mechanical failure that resulted in \$100,000. In design and replacement costs as well as a decrease in total on hand quantities of halon. The loss of agent was discovered during annual PM of the system. In process of weighing cylinders, it was discovered that two of the four cylinders (one main and one reserve) had lost their agent. Upon investigation, it was determined that the failure was the result of a defective o-ring within the actuator head on each cylinder and was a manufacturer defect. This loss of agent resulted in a design effort for replacement of the system.	\$100,000.00

¹⁰ The above figure does not consider system leakage in a stable condition.

Table 6: Non Water Based System Actuations			
LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Release	SRO / SRS	SRS reports that this amount was released during maintenance activities over the year (recovery activities).	\$0.00
Release	SRO / SRS	System discharged main cylinder due to operations error by inadvertently de-energizing the main breaker at the electrical panel.	\$0.00
Release	SRO / SRS	6 17# Halon cylinders Caused by the resetting of the FIU/ZIU panel in Zone 571.	\$0.00
Release	SRO / SRS	Plastic manual pull station fractured from installation, released and dumped the Halon	\$0.00

Comparing total (active, inventory, and banked amounts) Halon 1301 stores reported in CY 2000 (356,964 pounds) to those reported in CY 1999 (358,799 pounds) indicates that DOE's Halon supply shrunk by 1,835 pounds. Comparing this difference to the drawdown amount (1,338 pounds) leaves a discrepancy of approximately 497 pounds. This discrepancy relates to amounts lost either through leakage or accounting revisions.

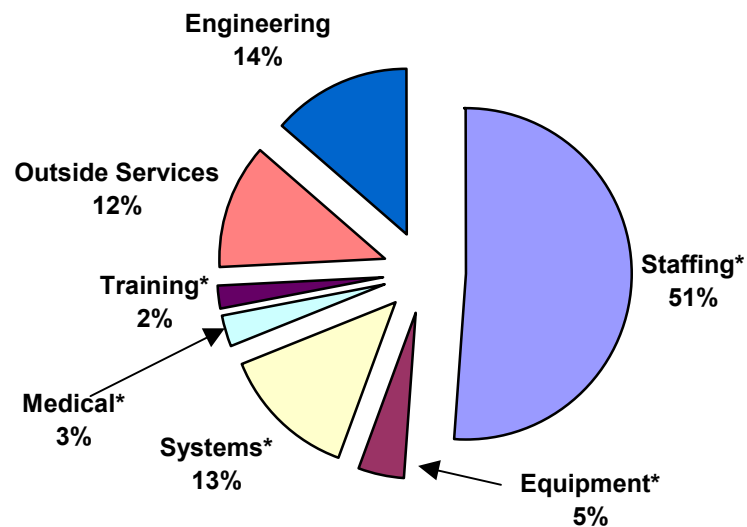
Sites considering any Halon transfers outside the DOE are reminded that a Halon bank has been established so that reserve capacity can be maintained for mission essential systems in the complex that have not yet been replaced. The SR Fire Department may be contacted for further information regarding Halon transfers.

RECURRING FIRE PROTECTION PROGRAM COSTS

Yearly or recurring fire protection costs for CY 2000 reached \$131,828,186. for the DOE Complex. On a ratio of cost to CAIRS property value (recurring cost rate), the DOE spent approximately 12.86 cents per \$100 property value for recurring fire protection activities, 1.45 cents more then the previous year.

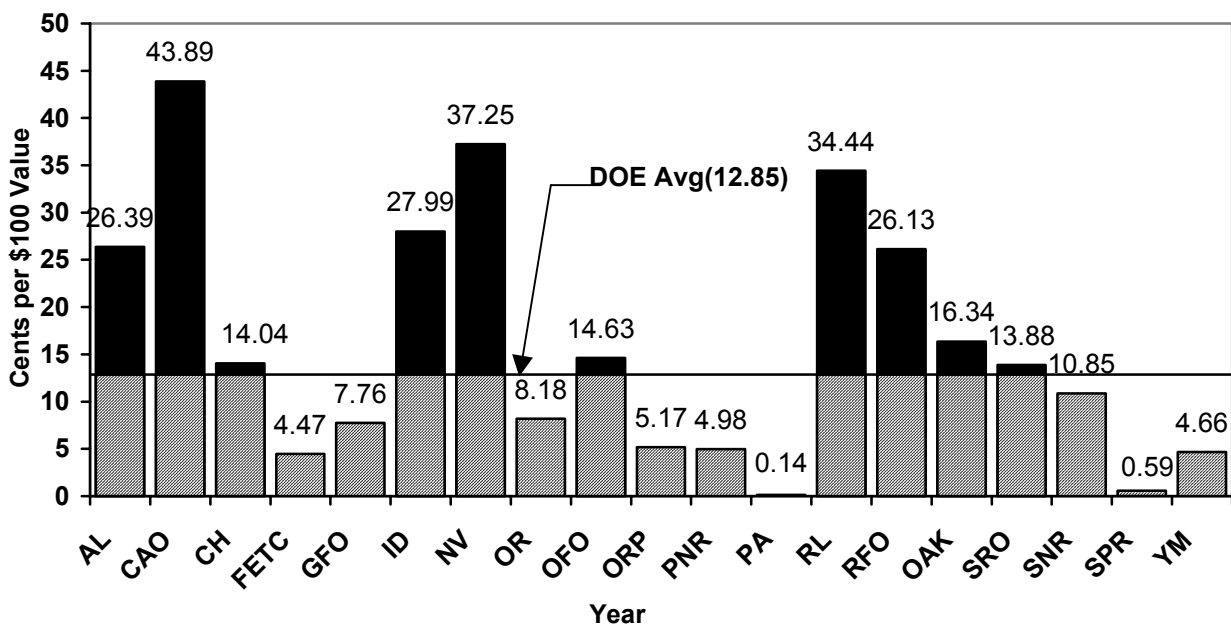
Figure 11 shows the CY 2000 recurring cost distribution by activity. Figure 12 lists the recurring cost rate by DOE field organizations. It should be noted that not all recurring cost activities were consistently reported, such as outside contracts and maintenance activities. Additionally, sites that did not report recurring costs this calendar year (primarily ETTP, LANL and Sandia) had their costs carried forward from the past reporting period to maintain the validity of the statistic. Had these costs been omitted from the database, the DOE would have experienced a decrease in the recurring cost amount by approximately \$19,878,569.

Figure 11
Recurring Fire Protection Cost Distribution



- Fire Department Activities

Figure 12
Cost Rate by Operations Office



The following is a summary of fire department responses for CY 2000. These numbers represent data sent in from approximately 20 of the 22 fire departments stationed at DOE sites.

1. Fire	846
2. Hazardous Materials	407
3. Other Emergency	3,575
4. Other Non-Emergency	2,982
5. Medical	1,834
Total	9,644

Comparing this data to the actual type of response is difficult since sites do not report incident responses in a consistent fashion. The Office of Environment, Safety and Health is examining the use of a standard reporting format which complies with the National Fire Protection Association's Guide 901, "Uniform Coding for Fire Protection" that could be linked to other DOE incident reporting programs for an accurate and cost effective approach to data collection in DOE. Other options, such as folding DOE's fire data collection into State or National programs such as the National Fire Incident Reporting System, are also being considered.

CONCLUSIONS

DOE experienced no fatalities or major injuries from fire in CY 2000. This year however is considered the placeholder for the most devastating monetary fire loss in DOE history, the CerroGrande Wildland Fire. With an estimated loss starting at 100 million dollars, this event has prompted the DOE to consider issuing new policies or guidance for the treatment of wildland buffer areas surrounding our sites. The following table provides a historical perspective of DOE's wildland fire record, pointing out the fact that we are not new to the challenges of wildland fire management:

Year	No. Wildland Fire events	Total Cost (loss)
1991	4	\$20,893
1992	15	\$6,300
1993	2	\$26,500
1994	7	\$200,000
1995	33	\$271,074
1996	45	\$206,500
1997	16	\$0
1998	18	\$6,000
1999	21	\$165,680
2000	38	\$102,297,361

Fire Protection Summary
For Calendar Year 2000

The Annual Summary reporting process has recently been automated to streamline data collection and provide a more thorough review of DOE Reporting Element activities. This action resulted in the delayed publication of the CY 1999 and 2000 reports until 2002. Because of confusion surrounding this activity, it is theorized as the reason why the following sites have stopped providing an Annual Summary:

East Tennessee Technology Park
Grand Junction
Inhalation Toxicology Research Institute
Oak Ridge-Institute of Science & Education
Ross Aviation, Inc.
Sandia National Laboratories, Albuquerque
Sandia National Laboratories, Livermore
Western Area Power Administration

It is now possible to view all Annual Summary Reporting Element responses since 1991 at the Site, Operations, Lead Program Secretarial Office and Headquarters levels, as well as reference other DOE reporting activities (CAIRS and ORPS) To obtain a copy of the Annual Summary Application please contact Jim Bisker in the Office of Nuclear and Facility Safety Policy (EH-53) at 301.903.6542 or jim.Bisker@hq.doe.gov.